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54 **Laser marking.**

57 A method of marking a cable, such as an electrical cable for aircraft, using an excimer laser. The cable may contain a photosensitive substance such as titanium dioxide for permitting laser marking of the cable.

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## LASER MARKING

The present invention relates to laser marking and specifically, but not exclusively, concerns laser marking of aircraft cables.

The electrical cables used in aircraft are high quality cables in which an electrical conductor is covered by a polymeric insulating layer, such as that sold under the trade mark KAPTON, and an outer layer for permitting marking of the cable. The outer layer may take different forms eg. a tape of PTFE or ETFE wound on the cable, a dispersion containing PTFE or FEP in which the cable is dipped or an extrusion.

It is general practice in the aircraft industry to mark individual electrical cables repeatedly along their length with identification numbers before assembling the cables into looms for installation on an aircraft.

The current method of cable marking is hot stamp printing. This method has the disadvantage that it degrades the thermally insulating properties of the cable which can cause arc tracking.

It has also been proposed to use infra-red lasers for cable marking. One proposal involves coating cables in a proprietary coloured emulsion which changes colour when irradiated by a CO<sub>2</sub> laser. Another proposal is to include an extra outer layer on a cable which is coloured differently from the underlying layer and using an infra-red laser and a mark or laser scanning arrangement to remove parts of the extra layer to achieve the desired marking.

According to the present invention we provide cable comprising an electrical conductor surrounded by a polymeric insulating layer containing a photosensitive substance permitting marking of the cable by an intensive source of ultra-violet or visible radiation.

Advantageously, a cable according to the present invention may comprise only a single insulating layer thus enabling weight and cost savings in comparison with known high quality cables such as those used on aircraft.

The photosensitive substance may be titanium dioxide, which is presently used as a pigment or filler. Preferably, the insulating layer contains between up to 20% by weight of the photosensitive substance and preferably up to 5% by weight. It is thought that around 4% by weight may be the chosen amount.

It is possible that an article to be marked will be made so that the amount of the photosensitive substance in a surface layer of the article is enhanced relative to the remainder of the article.

The insulating layer may be made from polyimide and specifically may be made of the

material sold under the trade mark KAPTON.

It is thought that alternatives to titanium dioxide are possible and that, for example, zinc dioxide or tin dioxide may be suitable photosensitive substances for use in a cable according to the present invention.

According to another aspect of the present invention we provide a method of marking a cable such as an electrical cable using an intensive source of ultra-violet or visible radiation. Preferably, a laser source is used although a very intense UV flashlamp may be an alternative.

Preferably the method comprises irradiating the cable with an excimer laser, eg. a krypton fluoride (KrF) laser. A mask may be used to define the required marking.

It is found that an excimer laser operating between 100mJcm<sup>-2</sup> and 6Jcm<sup>-2</sup> marks aircraft cables without causing deterioration of the marked surface. Relatively low power excimer lasers can be used for cable marking thus providing a relatively economic and non-aggressive method of cable marking.

It should be understood that aspects of the present invention are applicable to articles other than electrical cables for aircraft. For example, the invention may be applicable to fibre optic cables or to tubes housing such cables and to a variety of articles other than cables

## Claims

1. A cable comprising an electrical conductor surrounded by a polymeric insulating layer containing a photosensitive substance permitting marking of the cable by intensive source of ultra-violet or visible radiation.

2. A cable according to claim 1 comprising a single insulating layer surrounding the electrical conductor.

3. A cable according to claim 1 or claim 2 wherein the photosensitive substance is titanium dioxide.

4. A cable according to any preceding claim wherein the insulating layer contains up to 20% by weight of the photosensitive substance.

5. A cable according to claim 4 wherein the insulating layer contains up to 5% by weight of the photosensitive substance.

6. A method of marking a cable such as an electrical cable using an intensive source of ultra-violet or visible radiation.

7. A method according to claim 6 comprising using a laser source.

8. A method according to claim 7 comprising using an excimer laser.

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	DE-A-2323799 (GUTEHOFFNUNGSHUTTE) * page 5, line 1-4; claim 1; figure 1 * ---	1, 2, 6, 7	H01B7/36 H01B13/00
E	FR-A-2617325 (AEROSPATIALE) * page 4, line 27 - line 30 * * page 6, line 8 - line 15; claim 3; figure 1 * ---	1, 6, 7	
A	GB-A-1199574 (MIDLAND SILICONES) * claims 1, 5 * -----	1, 3	
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			H01B B23K
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 26 JUNE 1989	Examiner DEMOLDER J.
<div>CATEGORY OF CITED DOCUMENTS</div> <div>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</div> <div>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... &amp; : member of the same patent family, corresponding document</div>			